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Original Article

SMART WATER MANAGEMENT AND WATER QUALITY MONITORING BY USING INTERNET OF THINGS

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ABSTRACT

One of the main concerns for green globalization is water contamination. Environmental monitoring is a fascinating system that plays a significant role in human life in the twenty-first century. Water quality must be monitored in real time to maintain the safe supply of drinking water and other water-related activities. This document shows a little effort stage progression and plan. The Arduino Uno microcontroller is used in this project, along with many sensors linked to the platform. The gadget, which consists of a variety of sensors, is used to measure the physical and chemical properties of water in diverse places. Factors like PH, Temperature and turbidity for water quality can be estimated. It is possible to quantify quality. The output of the sensors is kept in a data logger and transferred to the cloud over the Internet. As an acidic base, we can tell if the water is drinkable or not. In this research work, three sensors are used. These sensors are pH, Temperature sensor and ORP sensor.

KEYWORDS: Internet of Things, water quality, Sensors, Cloud Computing, Machine Learning

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INTRODUCTION

Monitoring the environment, as well as our health, is critical in our daily lives. It is linked to humans since monitoring the best of water and air around them will assist to raise awareness of the need to protect the environment, it is evident that awareness towards environmental issues is lacking. Water quality monitoring is becoming increasingly challenging as a result of global warming, limited water resources, and a growing population, among other factors. Modern techniques need to be implemented in order to improve water quality with due course of time. The wonderful features of the water. The familiarity with hydrogen particles is measured by pH. It reveals the water is acidic or basic. Water with a pH of 7 is pure; water with a pH of less than 7 is acidic, and water with a pH of more than 7 is soluble. It should be between 6.5 and 8.5 pH for drinking. The turbidity sensor detects the vast quantity of unspent particles in the water that are otherwise undetectable. It is observed that under low turbidity condition water is clear. The higher the turbidity, the greater the danger of cholera. River and lake water Temperature can be detected by temperature sensors can be logged and saved over cloud data storage. The traditional method for water quality testing is manually collecting water samples from various locations and submitting them to a lab for analysis after two days. Based on the information gathered, we may conclude that the water is safe to drink

LITERATUTRE REVIEW

Sokratis Kartakis, Edo Abraham, and Julie A McCann. (2015) developed a tool for monitoring, regulating, and simulating smart water networks. The water distribution network studies allow for the evaluation and identification of dynamic events (such as leaks) as well as energy 6 optimization. Furthermore, the findings aid managers in

making decisions [1]. Akshay Kumar, Prachet Verma, Pratik Jain discussed the design and implementation of IOT depending upon requirement ranging from large campus storage to medium scale water storage, it mainly focuses on low cost ultrasonic level sensor making use of wireless network technique for network connection for sensing overhead tank situated at distant places. [2]. Michel R. Machado, Tiago Ribas (2015) provides a smart water management system for water distribution support and loss prevention using the microcontroller ZR16S08 as an IoT solution. The water flow in pipe lines over water distribution network is being monitored by the system considering water losses are major concern in today's world [3]. Vijayakumar N., and Ramya R (2015) describe the implementation and design of a low-cost system for a real-time water quality monitoring system in the Internet of Things (IOT). The system, which consists of multiple sensors, is used to measure the water's physical and chemical characteristics. Temperature, PH, turbidity along with oxygen percentage and conductivity can be estimated [4]. Sayali Wadekar, Vinayak Vakare, Ramratan Prajapati (2016) describes an IoT gadget that aids in the management and planning of water usage. Apartment complexes can adopt installation techniques in easy steps. Sensors installed in the tank provide continual updates on the water level at any given time. This information will be updated on the cloud, and users will be able to visualise the water level on a Smartphone wherever that is linked to IoT using an Android application [5]. Ramesh, Maneesha Vinodini, Renjith Mohan, M. Nitin Kumar (2016) discussed the impact of the micro and macro water distribution networks on sustainability is also compared in this article. Water wastage, usage rate, source capacity, total network length, cost of deployment, source recharge, and network leakage rate are all used to define sustainability. The paper outlines a water distribution project that was carried out in two villages in India: 7 one in Orissa and the other in Rajasthan [6]. Bheki Sithole, Suvendi Rimer, Khmaiesouahada, C. Mikeka, J. Pinifolo (2016) discussed the amount of water consumed by a consumer can be measured using flow metre sensors. In accordance with South African Bureau of Standards (SABS) small flow meters can be placed with water pipes. The water use is measured by water flow metre technique of SWLDM. Water flow metres are used to determine the rate at which water passes at a specific spot [7]. Srinivasan, A. Sathish Kumar (2016) explained smart controller has a smart communication mechanism that allows the resource user and provider to communicate with one another. As a result, the Smart Controller system enables for remote resource consumption reading. When resources are scarce, we enable the resource provider to maintain a well-balanced resource structure to meet the needs of customers based on a prioritization system [8]. C.Myint, L.Gopal, Y.Aung (2017) demonstrates a reconfigurable smart sensor interface device system for a water quality monitoring. A Field Programmable Gate Array (FPGA). A personal computer make up the smart WQM system (PC) in addition with design, board and sensors, with Zigbee-based wireless communication module. The suggested system's basic component is an FPGA board that is programmed in a very high-speed integrated manner [9].

PROPOSED SYSTEM

We provide an Internet of Things (IoT) enabled multi-parameter water quality monitoring and contamination detection kit. The suggested kit may collect real-time data from the major water supply, analyse it, and display it on a simple platform for monitoring. It can monitor temperature (T), pH, and chloride concentration, which are all significant indicators of water quality. The on board processor may also be used to preprocess data before sending it to the cloud to estimate water quality. By going to their website and logging in. Users may check water quality on a regular basis as a graph and via an account, users can monitor water quality on a regular basis as a graph and through an account. We are estimating future demand of water by using Machine Learning concept.

In the proposed system, one main water resource is there and it is distributing water to three areas. Each consists

of one tank. Here we are implementing three sensor node, each node consist of one pH sensor, temperature sensor and ORP sensor. Our system consisting a program written in popular programming languages will be running in the controller eg. Arduinouno. Here we are using ORP sensor instead of chloride sensor. Because Chloride sensors are very costly. The below table shows the range of ORP sensor in mV for different types of water. Table I represents quality of water. figure 1 shows the complete hardware of the research.

TABLE 1

Parameter	Quality Range	Units
pH	6.5-8.5	pH
Electrical conductivity	500-1000	µS/cm
Turbidity	0-5	NTU
ORP	650-800	mV
Temperature	------------------	℃
Nitrates	<10	Mg/L

Figure 1: Hardware Architecture

TABLE 2

S No.	Type of Water	Range (mV)
1.	Safe Drinking Water	+200 mV to 600 mV
2.	Chlorinate pool water	+650mV to 750 mV
3.	For phosphorus removal	+25mV to +250mV
4.	Removal of Nitrogen	+100 mV to +350 mV
5.	Biological phosphorus	-100 mV to -250 mV
6.	Methane	-175 mV to -400 mV

ORP Sensors: The oxidation-reduction potential (ORP) is measured in millivolts of a chemical substance's likelihood to oxidise another chemical substance.

Fe = Fe+2 + 2 e- (Oxidation)

Cl2 + 2 e- = 2 Cl- (Reduction)

COMPLETE REACTION: Fe + Cl2 => FeCl2

In the above, iron (Fe) reduces chlorine (Cl2) acts as a reducing agent. Conversely, chlorine (Cl2) oxidizes iron

(Fe) which is an oxidizing agent.

The solution's oxidising or reducing power is often measured in terms of solution's oxidation-reduction potential. The oxidation or reduction is often described as a half-reaction, which gives all of the chemical components involved in the reaction, The ORP of the solution can be determined by logarithm of the concentrations of the compounds involved in the half reaction. An ORP measurement is useful for monitoring and controlling oxidation-reduction processes. The quality of water is determined by oxidation reduction potential (ORP) tool which gives accurate result. When a material lacking electrons, known as an oxidising agent, seeks electrons from other substances, oxidation occurs. Reducing agents, on the other hand, are compounds that have additional electrons to contribute pH Sensor:

The condition of water ie: acidic or alkaline is determined by pH sensor. The pH scale is used to represent the concentration of hydrogen ions. On a logarithmic scale the pH ranges from 0 to 14. A pH level of less than 7 is termed as acidic, whereas a pH level of higher than 7 is regarded as basic. Pure water has a pH range of 6.5 to 8, whereas pure water has a pH range of less than 6.5 and greater than 8. The number of people is increasing with time. The hydrogen ion concentration in water falls tenfold, making it less acidic nature on pH scale. The electrode and the reference electrode can be measured by a pH sensor. The estimating cathode and negative terminal of the sensors batteries are linked with the pH level. The reference anode is connected to the terminal. when the pH sensor was submerged in water. We get information from the reference electrode. The quantity of hydrogen ions in water falls tenfold, making it less acidic in pH meter. Sensor for measuring turbidity

The number of deferred particles in water that can be measured which is invisible to eyes is termed as turbidity. It might be soil particles or dirt in water, or chocolate flakes in our chocolate beverage.

The turbidity limit should be 1NTU.The limit for packaged drinking water is roughly 2NTU. The turbidity of drinking water should be in the range of 5NTU and 1NTU.The quantity of hydrogen ions in water makes it less acidic by falling tenfold in a range. The DHT11 is a temperature and humidity sensor that is widely used. Temperature and humidity measurement is carried by sensors which has dedicated NTC and 8 bit microprocessor throughout the process. The sensor is fully calibrated, making it simple to connect to other microcontrollers. With an accuracy of 1°C and 1 percent, the sensor can detect temperature from 0°C to 50°C and humidity from 20% to 90%.

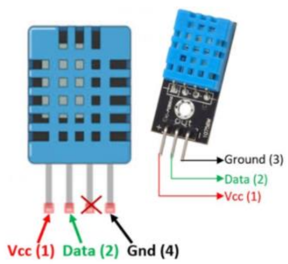

Figure 2: Pin Diagram for Temperature and Humidity Sensor (DHT11)

CONCLUSIONS

The sensor node is a full solution for checking the environmental quality of water. As a result, the system will use numerous sensors to monitor the water quality. Human healthcare, agriculture and fishing, The sensor node consist of pH,

Temperature sensor and ORP sensors.

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